

Appl. No. 10/030,903
Amdt. dated June 15, 2004
Reply to Office action of March 16, 2004

In the Claims:

Claim 15 is amended herein. The remaining claims are not amended in this response.

1-2. Canceled

3. (previously amended) An ink-jet imaging apparatus having a printing head having plural nozzles for ink ejection, and first ink ejection elements formed respectively near each of the nozzles for ejecting the ink from the nozzle; and forming an image by driving the first ink ejection element to eject the ink, wherein the ink-jet imaging apparatus comprises:

second ink ejection elements formed respectively upstream against the ink ejection direction before the first ink ejection element for ejecting the ink from the nozzles, and

a controller which drives, on prescribed ejection recovery, the first ink ejection elements and the second ink ejection elements simultaneously to eject the ink through the nozzles for ink ejection recovery,

wherein the controller functions to change timing of ink ejection of the ink ejection element in correspondence with the shape of the ink liquid face at the outlet of the nozzle, wherein the ink ejection element is operated at a time of a maximum outwardly extension of the ink liquid face for providing a greater volume of ink ejection for recovery purposes.

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4. (previously amended) An ink-jet imaging apparatus having a printing head having plural nozzles for ink ejection, and first ink ejection elements formed respectively near each of the nozzles for ejecting the ink from the nozzle; and forming an image by driving the first ink ejection element to eject the ink, wherein the ink-jet imaging apparatus comprises:

second ink ejection elements formed respectively upstream against the ink ejection direction before the first ink ejection element for ejecting the ink from the nozzles, and

a controller which drives, on prescribed ejection recovery, the first ink ejection elements and the second ink ejection elements simultaneously to eject the ink through the nozzles for ink ejection recovery,

wherein the controller is provided with a temperature sensor for detecting the inside temperature of the printing head, and

a controller which drives, on prescribed ejection recovery, both of the first ink ejection element and the second ink ejection element simultaneously at prescribed time intervals intermittently in correspondence with the temperature detected by the temperature sensor to eject the ink through the nozzles.

5. (original) The ink-jet imaging apparatus according to claim 4, wherein two or more of the printing heads are provided, and

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the controller decides the time interval for each of the printing heads in correspondence with properties of the ink to be ejected from the nozzle of each of the printing heads.

6. (previously amended) The ink-jet imaging apparatus according to claim 4, wherein a memory is provided for memorizing preliminarily the prescribed time interval varying in dependence of the inside temperature of the printing head for each of the inside temperature, and

the controller may control both of the first ink ejection element and the second ink ejection element to eject the ink at intervals memorized in the memory based on the inside temperature detected by the temperature sensor.

7. (previously amended) The ink-jet imaging apparatus according to claim 4, wherein the controller decides the number of times of simultaneous driving of the first ink ejection element and the second ink ejection element based on the temperature detected by the temperature sensor.

8. (original) The ink-jet imaging apparatus according to claim 7, wherein two or more of the printing heads are provided, and the controller decides the above-mentioned number of times for each of the printing heads independently in accordance with properties of the ink to be ejected through the nozzles of each of the printing heads.

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9. (original) The ink-jet imaging apparatus according to claim 6, wherein the memory memorizes the number of times of simultaneous driving of the first ink ejection element and the second ink ejection element, varying with the inside temperature of the printing head, and

the controller controls both of the first ink ejection element and the second ink ejection element to eject the ink in the number of times and in the time intervals derived from the memory depending on the inside temperature detected by the temperature sensor.

10-12. (canceled)

13. (previously amended) An ink jet imaging apparatus having a printing head having plural nozzles for ink ejection, and first ink ejection elements formed respectively near each of the nozzles for ejecting the ink from the nozzle; and forming an image by driving the first ink ejection element to eject the ink, wherein the ink jet imaging apparatus comprises:

second ink ejection elements formed respectively upstream against the ink ejection direction before the first ink ejection element for ejecting the ink from the nozzles, having higher ink ejection performance than the first ink ejection elements,

wherein a controller is provided which drives the first ink ejection elements at a prescribed first timing, and drives the

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second ink ejection elements at a second timing later than the first timing,

wherein a counter is provided for counting the number of times of driving of the first ink ejection elements, and

the controller drives the second ink ejection elements when the count of the counter reaches a prescribed number of the times,

wherein a temperature sensor is provided for detecting the inside temperature of the printing head, and

the controller may change the number of times of driving of the second ink ejection element in accordance with the temperature detected by the temperature sensor.

14. (previously amended) The ink-jet imaging apparatus according to claim 15, wherein the above ink ejection element is a heater element which generates heat, or a piezo element which causes a piezo electric effect.

15. (currently amended) An ink-jet imaging apparatus having a printing head having plural nozzles for ink ejection, and plural ink ejection elements formed respectively near each of the nozzles for ejecting the ink from the nozzle; and forming an image by driving any of the ink ejection elements to eject the ink in accordance with image information signals, wherein the ink-jet imaging apparatus comprises:

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a controller which drives, on prescribed ejection recovery, two or more of the ink ejection elements simultaneously to eject the ink through the nozzle for ink ejection recovery,

wherein the controller functions to change timing of ink ejection of the ink ejection element in correspondence with the shape of the ink liquid face at the outlet of the nozzle, wherein the ink ejection element is operated at a time of a maximum outwardly extension of the ink liquid face for providing a greater volume of ink ejection for recovery purposes.

16. (previously presented) The ink-jet imaging apparatus according to claim 5, wherein a memory is provided for memorizing preliminarily the prescribed time interval varying in dependence of the inside temperature of the printing head for each of the inside temperature, and

the controller may control both of the first ink ejection element and the second ink ejection element to eject the ink at intervals memorized in the memory based on the inside temperature detected by the temperature sensor.

17. (previously presented) The ink-jet imaging apparatus according to claim 5, wherein the controller decides the number of times of simultaneous driving of the first ink ejection element and the second ink ejection element based on the temperature detected by the temperature sensor.

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18. (previously presented) The ink-jet imaging apparatus according to claim 6, wherein the controller decides the number of times of simultaneous driving of the first ink ejection element and the second ink ejection element based on the temperature detected by the temperature sensor.

19. (previously presented) The ink-jet imaging apparatus according to claim 17, wherein two or more of the printing heads are provided, and

the controller decides the above-mentioned number of times for each of the printing heads independently in accordance with properties of the ink to be ejected through the nozzles of each of the printing heads.

20. (previously presented) The ink-jet imaging apparatus according to claim 18, wherein two or more of the printing heads are provided, and

the controller decides the above-mentioned number of times for each of the printing heads independently in accordance with properties of the ink to be ejected through the nozzles of each of the printing heads.

21. (previously presented) The ink-jet imaging apparatus according to claim 16, wherein the memory memorizes the number of times of simultaneous driving of the first ink ejection element

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and the second ink ejection element, varying with the inside temperature of the printing head, and

the controller controls both of the first ink ejection element and the second ink ejection element to eject the ink in the number of times and in the time intervals derived from the memory depending on the inside temperature detected by the temperature sensor.

22-23. (canceled)